

F U N C T I O N A L A L B U M I N U R I A

by

EDGAR SOMERVILLE,

M.B., Ch.B.
F.R.C.S.E.



This title is meant to signify the presence of Proteid Matter in the urine of persons who are apparently healthy, and in whom there are no other evidences of kidney disease.

Attention was first called to this kind of albuminuria by Sir Robert Christison, many years ago, who pointed out that the use of certain articles of diet induced temporary albuminuria.

Jaccoud in 1864, drew a distinction between cases of persistent albuminuria in which the patient remained in good health, and albuminuria associated with Bright's disease.

In the Guy's Hospital Reports of 1873, Dr Moxon published a paper on the albuminuria of adolescence, and pointed out that it is a state of health to which young men are frequently subject.

Dr Morely Rooke in the British Medical Journal of 1878 drew attention to the remarkable effect of rest in the recumbent posture in removing or keeping in abeyance the albuminuria of adolescence. And in the same journal in that year Dr Burney Yeo dwelt upon the importance of muscular exercise as an exciting cause.

Dr Clement Dukes, from his experience as Physician to Rugby Public School in discussing albuminuria of/

of adolescence, pointed out how extremely common the condition is, and the variety of features it presents, both in its causation and special characteristics.

Dr Pavy at the meeting of the British Medical Association in 1885 suggested that the term "Cyclic Albuminuria" should be applied to this condition.

Sir T. Lauder Brunton in his article in Quain's Dictionary of Medicine considers albuminuria to be of two kinds, true and false. In the former variety, he states there is always some change either in the circulation through the kidney, or in the structure of the kidney itself. In the latter, the albuminous matter passes out through the kidney, without there being any alteration either in its circulation or structure.

Valuable contributions to the subject of Functional Albuminuria were made by Dr Senator of Berlin in 1884, and by Sir Thomas Grainger Stewart in 1888, who made many and extensive experiments on soldiers and school children and other presumably healthy people.

Having briefly referred to the literature on the subject, I purpose to discuss in turn the Aetiology, Symptomatology, Diagnosis, Prognosis and Treatment of the Condition.

Aetiology/

Aetiology.

The causation of functional albuminuria is very varied, in some instances an origin can be readily found, while in others it is almost impossible to arrive at any cause to which the presence of albumin in the urine can be definitely ascribed. It sometimes happens in the case of a young man, to all appearance in perfect health and strength, who is being proposed for Life Insurance, or who is offering himself as a candidate for one of the Public Services, that in the Medical Examination his urine is found to contain albuminuria. His personal and family history may be excellent, and he may never have had scarlet fever. In such a case as this, it is exceedingly difficult to find any cause for the albuminuria.

Among the commonest causes may be mentioned errors in diet. Albumin is found in the urine of certain people after taking cheese, pastry, nuts or eggs, in large quantity. If egg-albumin be taken daily by the stomach in very large quantity for some days, albumin is found in the urine. A similar result may be obtained by injecting egg-albumin into the rectum, or directly into the circulation or under the skin.

Food has a three-fold influence on the occurrence of albuminuria. In the first place, albumin may/

may, as I have already mentioned, occur in the urine after indulgence in certain articles of diet, as eggs, cheese, and pastry. Secondly, the time of day, and season of the year may play an important part, food taken at breakfast or at ^{the} mid-day meal, sometimes producing albuminuria, while the same food taken in the evening fails to make any change in the condition of the urine, so also albumin may appear in the urine in summer and not during the winter. Thirdly, the very fact of the entrance of food into the stomach, may induce albuminuria; this is illustrated by the urine passed immediately before a meal, being found normal while that passed after the commencement of that meal is found to be albuminous.

Albumin in the urine, produced by breakfast can often be much increased in amount by taking exercise immediately after that meal, while later on in the day, when the urine does not contain albumin, any amount of exercise will not produce it.

It is difficult to arrive at a satisfactory explanation of albuminuria arising from dietetic causes. The degree of filtration of albumin is influenced by the amount of saline material in the blood; excess of salts producing a greater degree of filtration. It may be possible that after a meal, the salts in the blood are increased in amount and/

and so transudation of albumin into the urine is facilitated. But the most probable explanation is that the albuminuria is the result of some reflex vascular condition, the entrance of food into the stomach producing a morbid influence on the vagi. This is borne out by the fact that albumin makes its appearance in the urine almost immediately after food has reached the stomach, in which case, of course, no sufficient time can have elapsed for absorption and excretion to take place.

Albuminuria may occur in some people as a result of muscular exertion. In this type of case, the patient's urine remains free from albumin so long as he is lying at rest in bed, but a small amount of exercise, even that produced by dressing and walking about his bed-room will be sufficient to produce albuminuria, which again disappears with rest in the recumbent posture. On the other hand, exercise of the arms in a sitting posture has no effect in producing albuminuria. Thus, if the patient do dumb-bell exercises with his arms while sitting up in bed, no albumin is found in the urine; but if the same exercises be performed while he is in the erect attitude, the urine is found to be albuminous. The explanation of albuminuria under these circumstances is not quite clear. Although it is improbable that there are any gross changes in the secreting/

secreting renal tissues, there may be some molecular alterations of the cells in the Malpighian tufts dependent upon congenital peculiarities, which permit the transudation of albumin along with the water of the blood serum. But it is very doubtful if there is sufficient evidence in favour of such a view.

There are some considerations which favour the view that the origin may be attributed to chemical changes in the serum, viz. the occasional coexistence of other morbid states of the urine, as glycosuria, phosphaturia and oxaluria. Of course, no change in the renal blood pressure or in the walls of the vessels or in the Epithelium of the tubules can account for these, and it seems necessary to conclude either that the albuminuria and they, are the common results of a faulty metabolism, or that independently of alteration in the kidney inducing the one, there are alterations in the liver and other organs producing the others.

Sir Thomas Grainger Stewart was of the opinion that this variety of albuminuria had its origin in vascular changes. In his book on the subject, he observes:-

"The marked influence of muscular exercise and exercise of particular kinds and in particular postures, does not seem readily explicable on the chemical hypothesis, while what we know of the physiology of/
of/

of the blood-vessels prepares us to believe that alterations of their lumen and of the blood pressure within them, might readily be induced under such circumstances, and result in the symptom in question. The occasional occurrence of glycosuria and the excess of bile salts might be advanced as difficulties in the way of this explanation, but it is easy to conceive that a general change in vascular activity which in the kidney induces albuminuria, might by its influence on the liver, induce the other abnormalities."

Albumin may appear in the urine after mental emotion or prolonged mental strain.

By some, functional albuminuria is looked upon as a physiological cyclic change analogous to phenomena of a diurnal character, and comparable to the Phosphatic Diathesis.

There is a variety of albuminuria which appears to bear a strong relation to Paroxysmal Haematuria or Haemoglobinuria. - In fact, in some people who suffer from Haemoglobinuria, for the few days which immediately precede the attack, the urine is often found to be albuminous.

An attack of Paroxysmal albuminuria may be brought on by exposure to cold or wet, by alcoholic excess, and sometimes even by dietetic errors.

Symptomatology/

Symptomatology.

Although in the majority of healthy people, the urine contains no albumin; in between 20% and 30% of the apparently healthy, proteid matter can be found at some micturition in the twenty-four hours. It varies considerably in amount, in some instances being readily detected by boiling or by the addition of Nitric Acid in the cold, in others the slight haze at the interface of the urine and nitric acid, indicating the presence of albumin, can only be seen after allowing the specimen to stand for a considerable time. In other instances, boiling and Nitric acid fail to elicit proteid matter, and its presence can only be revealed by special tests - as by Picric acid.

The albuminuria of adolescence may be regarded as simply a state of debility, in which the patient appears to be "out of sorts" and lethargic, he is anaemic, and about the eyes there is a grey sunken appearance, he sleeps too much, but does not awake refreshed.

The symptoms are very variable, depending in most cases upon the cause of the albuminuria. In some instances, there may be no symptoms, and the patient imagines himself to be perfectly healthy until he is informed that his urine contains albumin.

The albumin may be always present at every micturition/

micturition in the twenty-four hours. Or it may only appear after certain articles of diet, or after muscular exertion, or mental emotion. In other instances, the only symptom complained of, is a slight headache after muscular exercise or mental excitement, which passes away on resting.

The amount of albumin in the urine varies very much in the same individual, sometimes there is a precipitate produced by Nitric Acid, and at other times, a slight haze can only be distinguished after standing a few minutes.

In the majority of cases of Functional Albuminuria, no tube casts are to be found, but in a small minority, some hyaline tube casts are occasionally seen.

There is no puffiness of hands, face or conjunctiva, nor is there oedema of any part of the body. The normal amount of urine is passed in twenty-four hours.

The amount of urea excreted in the twenty-four hours is never below, and is sometimes found to be in excess of the normal.

The specific gravity is normal.

The urine is often found to contain other abnormal substances, in more or less abundance, as oxalates, urates, phosphates and bile acids.

En/

In most cases, there is always some period of the day, at which the urine is found to be free from albumin.

But in a very few cases albumin is always present, although at times it may only be a trace which is present.

There are no changes in any of the other systems of the body, the circulatory system being quite normal, and there are no Retinal changes.

The presence of albumin is particularly noticeable in the urine passed after breakfast, while at other times not a trace can be found. Muscular exercise, errors in diet, or mental emotion produce marked effects, while rest in the recumbent attitude, light diet and a life as free from mental emotion as possible, keep the albuminuria in abeyance. The effect of diet is very variable, merely the addition of bread to a milk diet may produce albumin in urine which did not previously contain any; and although while going about, the patient may require to limit his diet in the strictest way, on keeping at rest in bed, he may be able to eat and drink much more freely without albumin making its appearance in the urine. Dumb-bell exercise, which when performed in the erect attitude produced albuminuria may fail to do so when the exercises are performed in a recumbent posture.

In/

In some instances, it appears to bear rather a close analogy to Paroxysmal Haemoglobinuria, appearing and disappearing in the same manner, here the albumin lasts a varying length of time, generally a few days to a week, during which time the urine in addition to containing proteid matter may contain many tube casts - epithelial, granular and hyaline. One attack having passed off the urine resumes its normal condition until another attack comes on.

Dr Collier, in the British Medical Journal, drew attention to the frequency of albuminuria in Undergraduates at Oxford, many of them, to all appearance in the best of health, coming to him to get his opinion on their fitness for rowing.

Sometimes the effect of exercise in these cases is so marked, that while the urine first passed after exercise will contain a very distinct trace, urine passed an hour or two later, will contain either no albumin or only a very slight trace. His explanation of this form of albuminuria is that there is some defect in the wall of the blood vessels, which supply the kidney, that with the increase of blood pressure, which is the first result of muscular effort, the defective walls allow a certain amount of serum to escape, and the more often the muscular exercise is repeated, the more easy it becomes for the serum to transude.

Diagnosis/

Diagnosis.

In some instances it is very difficult to arrive at a diagnosis of Functional Albuminuria and not unfrequently it is a matter of grave responsibility.

It is first of all necessary to ascertain whether the albumin is always present in the urine at every micturition in the twenty-four hours. If it is ever absent the cause of its appearance must be found out. If muscular exercise be the cause, and the patient remain at rest in bed, does the albumen absolutely disappear from the urine? or is it only reduced in amount? Is it only present after taking certain articles of diet?

If, after the removal of the cause, the urine is found to contain no albumin, or the appearance of albumin ~~of albumen~~ is found to be cyclic, diurnal or annual, the diagnosis of Functional Albuminuria is rendered probable. At the same time, the absence of albumin from the urine passed immediately on rising in the morning does not exclude the possibility of organic disease of the kidney, as this condition is sometimes seen in commencing cirrhosis, also in some slight tubular inflammation, albumin may appear in very cold weather. If the albuminuria be constant, there is more probability of/

of there being some organic change in the renal tissue but many cases of this variety get perfectly well after a few years.

The quantity of albumin found in the urine is not to be considered of any great diagnostic importance .

In some functional cases, the amount of albumin present may be very considerable, in others, there may be only a trace: While in organic renal disease, it is abundant in the inflammatory variety, and in the cirrhotic and waxy varieties especially in an early stage it is very small in amount, and at certain times in the day it may be quite absent.

The variety of albumin is not of much assistance in arriving at a diagnosis, and authorities hold different opinions on the subject, some hold with Maguire that a large proportion of globulin is suggested of the albuminuria being functional; others, and among them is Senator, consider it characteristic of waxy disease.

The quantity of urine passed in the twenty-four hours is of great importance.

In the functional cases, the amount of urine passed does not exceed the normal. While a condition of polyuria points to organic change either of a cirrhotic or an amyloid nature. If the amount of urine be less than normal, and after the question of/

of diet has been carefully enquired into, and no evidence of any obstruction having been formed in the urinary tract below the kidneys, the cause will probably be found to be due to the result of inflammatory occlusion of the uriniferous tubules.

The amount of urea excreted is a very important consideration. In functional cases, the amount is either normal or rather in excess of the normal, never below. In the early stages of waxy disease, the amount of urea nearly approaches the normal, but as the disease advances there is a very obvious diminution. In cirrhotic disease of the kidney, there is a marked diminution in the amount of urea from the onset.

The specific gravity should be carefully noted. In cirrhotic and waxy disease it is subnormal. If normal, or above the normal, it is indicative either of Functional Albuminuria, early inflammatory condition, fever, glycosuria or cardiac disease.

In the majority of functional cases of albuminuria, no tube casts can be found in the urine, but in a small minority of these cases some hyaline casts have been found. The presence of Epithelial and fatty casts indicates the existence of inflammatory mischief in the tubules.

The occurrence of oxalates, phosphates and urates along with albumin is often of assistance in/

in arriving at a diagnosis of Functional Albuminuria.

This is particularly noticable in a sudden and copious deposit of the two former - oxalates and phosphates.

The appearance of the patient is often of some importance.

The presence of dropsy indicates either inflammatory disease, cardiac disease, or a state of great deterioration of the blood. But the mere absence of oedema does not exclude the possibility of organic disease, as little or none is present in the early stages of cirrhotic and waxy disease.

The condition of the other systems may be of assistance.

In the alimentary system, enlargement of the liver, or intractable dyspepsia and diarrhoea accompanying the kidney symptoms, would point to waxy disease. It should also be noted what effect the ingestion of food, and the process of digestion have upon the appearance of albumin in the urine.

The circulatory system is normal in those cases of albuminuria which are functional. While in chronic renal disease the vascular tension is raised, sometimes to a very high degree, the pulse being hard and incompressible, and there are evidences of cardiac hypertrophy, the first sound being prolonged and/

and booming in character, the second shewing marked accentuation in the aortic area.

In the Haemopoietic system, there is but little assistance.

With other symptoms, an enlarged spleen would indicate waxy disease.

In the nervous system, an ophthalmoscopic examination of the retina assists one in diagnosis. In cases where the albuminuria is functional, the retina is normal. In organic disease, one finds "Albuminuria Retinitis."

Headaches are often associated with chronic renal disease being particularly noticeable and obstinate to treatment in those cases where there is any Uraemic tendency.

Headaches may occur in functional cases, especially after prolonged and severe muscular exercise, and after mental emotion. On the whole, the state of the other systems does not assist us much in differentiating functional albuminuria from that due to organic lesion, except that evidences of long standing suppuration as Phthisis in the respiratory system, and caries or necrosis in the Locomotory system indicate Amyloid degeneration of the renal tissue.

Before arriving at a diagnosis of Functional Albuminuria, it is very necessary to exclude "accidental albuminuria."

By/

By accidental albuminuria is meant the contamination of healthy urine, originally free from any proteid matter, by some impurity containing albumin, as seminal discharge, the discharge from the Urethra in specific urethritis, or Vaginitis.

Prognosis.

In cases of Functional Albuminuria, the prognosis is good, particularly in those varieties which are produced by errors in diet and excessive muscular exercise. If albumin be always present in the urine, the prognosis is not quite so good, and some authorities consider this variety is associated with structural changes in the kidneys.

Functional Albuminuria has an important bearing on Life Insurance. In fact, in many instances, it is only at the Medical Examination for Life Insurance that a candidate is found to have albuminuria. Authorities are very much divided as to what course the Medical examiner should take under these circumstances, i.e. whether the life should be refused, or only accepted at a higher premium. Dr George Johnstone was of the opinion that the candidate should be refused if his urine at any time contained albumin. Sir Thomas Grainger Stewart and Sir William Roberts considered that he might be accepted but with some addition to the premium.

Albuminuria may persist for an indefinite period sometimes throughout life, often into middle age.

Treatment/

Treatment.

The treatment of dietetic albuminuria must be studied in each individual case, and will depend upon the peculiarities of the individual. Those articles of diet which produce albuminuria must be avoided, as eggs, cheese, nuts, also raw albumin in the form of underdone meat should be forbidden. The effect of milk diet is to diminish the amount of albumin in the urine, but the quantity of urine, itself, is increased, which to some extent may account for this. In the variety in which albumin follows muscular exercise, severe or sudden exercise of every kind must be avoided, just so much exercise being taken as will maintain the individual in health. Competitions, involving great muscular exertion, such as rowing in races and running in athletic sports should be given up, and the patient should take to less violent forms of exercise, as golf, sculling or lawn tennis.

Mental strain or emotion should be avoided.

It is advisable that he should ^{not} indulge in cold baths, and should be warmly clad.

The urine should be examined from time to time, and the quantity of albumin estimated.

Attention should be given to the general health, and cod-liver oil, arsenic, iron, strychnia and quinine should be tried.

In/

In Paroxysmal Albuminuria during the attacks, the patient should remain at rest in bed, means should be adopted to get the skin to act freely, and diluent drinks should be given freely.

Other abnormal constituents of the urine should be treated on the usual lines: oxalates - by mineral acids and bitter infusions, etc.

The following case came personally to my notice as an example of Functional Albuminuria arising from Muscular Exercise.

The patient is a young man, aged twenty-four years.

Family history is good.

Previous illnesses. Except Influenza, none beyond Childrens' complaints.

History of Present Illness. In August 1894, he contracted scarlet fever, shortly after an attack of Influenza, which had left him in poor health.

The fever ran through its usual course and was mild in character. No chill or relapse occurred. During this period the mornings urine was tested regularly, and was found to contain no albumin. Five weeks after the commencement of the illness, the evenings urine, which had never been examined before, happened to be tested and was found to be albuminous.

Throughout/

Throughout the entire time of convalescence, albumin was noticed off and on in the evenings urine, this was particularly marked if the patient had had any fatigue during the day, but never in the mornings urine, of which the sample tested was always passed before rising. The patient remained at home for five months, until the end of February 1895, at which time, being in the same condition, he went to the south of France, where he stayed three months. During the whole period of this time, his evenings urine was found to contain albumin, but the urine passed immediately on rising and before he began to dress and move about was free from it.

He returned home in May 1895, where he remained for a couple of years. Throughout this period, albumin was found to be present off and on in the evenings urine.

If he played golf or took any form of exercise, albumin always made its appearance, except on frosty and very bracing days when albumin was occasionally not found after exercise.

During the summer of 1896, the urine passed an hour or so after rising was tested for the first time, and found to contain albumin. In consequence of this, the urine was tested more frequently during the/

the day, and the following facts were ascertained:-

The urine passed after the exertion of dressing and the consequent change of posture from the recumbent to the upright invariably contained albumin, even before any food had been taken.

The urine passed after breakfast also contained albumin.

If absolute rest was maintained for the remainder of the day, albumin made no further appearance.

If, however, exercise was taken, especially of an active form, such as a smart walk, though only for a short distance, albumin reappeared, and on some occasions the precipitate was very dense.

In close and depressing weather, albumin was sometimes present apart from the above causes.

The experiment of exercise of the arms by means of dumb-bells in a sitting posture was tried on several occasions, and it was found that this did not cause albumin to appear, although dumb-bell exercises in the erect attitude produced albuminuria.

Gentle horseback exercise did not cause albumin to make its appearance, but if the patient rode fast or for any length of time, albumin appeared. Similar results were obtained after a bicycle ride, i.e. if he went slowly and along level ground, no albumin/

albumin appeared, but if he rode uphill or exerted himself very much there was always albuminuria.

Urinary system. On palpation of the kidneys, nothing abnormal could be elicited.

Urine. The quantity passed in twenty-four hours was fifty ounces.

Colour. Amber.

Specific gravity. 1018.

Reaction. faintly acid.

Odour. normal.

Deposit of urates and oxalates, and mucus.

Quantity of urea. 500 grains, in the twenty-four hours.

Albumin present at certain periods mentioned above.

The quantity of albumin present varied considerably with the cause which produced it, see table.

No blood, no sugar, no peptone, trace of Bile Pigment.

Microscopically.

Deposit. Crystals of oxalate of lime, amorphous urates.

No tube casts.

The other systems on examination were found normal, there being no cardiac hypertrophy, and no increase in vascular tension.

Ophthalmoscopic examination revealed nothing abnormal/

normal.

Diagnosis.

Functional Albuminuria. The reasons for arriving at this diagnosis are as follows:-

There was always one fixed period of the day, at which the urine was free from albumin, whether it was present or absent during the rest of the day depended upon certain conditions.

The Specific Gravity of the urine was not sub-normal.

The quantity of urea was normal. On all occasions on which the urine was examined microscopically no tube casts were found.

Other abnormal substances were found to be present on many occasions, as oxalates, urates phosphates and bile acids.

The circulatory system was found to be normal in every respect. There was no cardiac hypertrophy, neither was the pulse tension raised above normal.

There was no albuminuria retinitis or any changes in the eye indicative of Chronic renal disease.

No oedema at any time.

It is now six years since the albumin was first discovered, and although the condition of the urine has not altered, the patient's health has not deteriorated, in fact it has in many ways improved, and he has graduated at Cambridge University.

No/

No signs of renal disease have appeared, as must certainly have been the case by this time, had the condition been any thing but functional.

There obviously still remains a very wide field for further investigation into this condition; which, judging from the scanty literature on the subject, has only begun to be considered within the last four years. More exact information with regard to the Aetiology must be collected; and with the assistance of our more delicate methods of staining we can examine more carefully into the minute Anatomy of the Renal Epithelium, and satisfy ourselves as to any distinctive evidences of morbid change.

As the number of applicants for Life Insurance increases, and more cases of this variety of albuminuria are brought to light, we are afforded further opportunities for the careful study of this very interesting condition which is still to some extent shrouded in obscurity.

T A B L E.

Time of Micturition.	Specific Gravity.	Reaction.	Amount of Albumin.
7.30. a.m. before rising.	1024.	Acid.	<u>none</u>
8. a.m. after dressing and before breakfast.	1020.	Acid.	.219 grains per ounce.
9.30.a.m. after breakfast.	1023.	Neutral.	a trace.
1.p.m. after morning of rest.	1017.	Faintly acid.	almost im -perceptible.
5.p.m. after exercise.	1019.	Acid.	.65625 grains per ounce.
10.30 p.m. at bed-time and after a rest.	1023.	Acid.	Trace.